

WHAT IS CLAIMED IS:

- 1 1. A planar structure expandable into a 3-D structure, the planar
2 structure comprising:
3 first and second spaced side beams which extend along a longitudinal
4 axis; and
5 a plurality of spaced cross-bands which connect the side beams
6 together wherein a first set of the cross-bands are expandable in a first direction
7 substantially perpendicular to the longitudinal axis to form a 3-D structure.
- 1 2. The planar structure as claimed in claim 1, wherein a second
2 set of the cross-bands are expandable in a second direction substantially opposite the
3 first direction to form a mesh-like 3-D structure.
- 1 3. The planar structure as claimed in claim 2, wherein adjacent
2 cross-bands are expandable in the opposite directions to form a mesh-like 3-D
3 structure.
- 1 4. The planar structure as claimed in claim 1, wherein the planar
2 structure plastically deforms during expansion so that the 3-D structure is free
3 standing.
- 1 5. The planar structure as claimed in claim 2, wherein the planar
2 structure plastically deforms during expansion so that the 3-D structure has a
3 cylindrical geometry.
- 1 6. The planar structure as claimed in claim 2, wherein the 3-D
2 structure is a tubular stent.
- 1 7. The planar structure as claimed in claim 1, wherein the planar
2 structure includes a conductive foil.

1 8. The planar structure as claimed in claim 1, wherein each of
2 the cross-bands includes a series of folded beams.

1 9. The planar structure as claimed in claim 8, wherein the folded
2 beams have an involute pattern.

1 10. The planar structure as claimed in claim 8, wherein the folded
2 beams have a switchback pattern.

1 11. The planar structure as claimed in claim 8, wherein each of
2 the cross-bands includes hinges for interconnecting adjacent folded beams.

1 12. The planar structure as claimed in claim 1, wherein the side
2 beams and cross-bands include biocompatible surface coatings.

1 13. The planar structure as claimed in claim 1, wherein the side
2 beams and cross-bands are made of a biocompatible metal.

1 14. The planar structure as claimed in claim 1, wherein the cross-
2 bands are made of a shape-memory alloy and wherein the planar structure is self-
3 expandable.

1 15. The planar structure as claimed in claim 1, wherein the side
2 beams and cross-bands are made of at least one of a biocompatible and a
3 biodegradable polymer.

1 16. The planar structure as claimed in claim 1, wherein the side
2 beams and cross-bands are formed by removing material from a sheet of material.

1 17. The planar structure as claimed in claim 16, wherein the sheet
2 of material includes conductive foil and wherein side beams and cross-bands are
3 formed by electric discharge machining the conductive foil.

1 18. The planar structure as claimed in claim 1, wherein at least
2 the first side beam includes a link portion having a mechanical strength lower than
3 other portions of the first side beam to allow the first side beam to break at the link
4 portion during expansion of the first set of cross-bands.

1 19. The planar structure as claimed in claim 18, wherein the link
2 portion is thinned relative to the other portions of the first side beam.

1 20. The planar structure as claimed in claim 18, wherein the link
2 portion is made of a fragile material relative to the other portions of the first side
3 beam.

1 21. The planar structure as claimed in claim 18, wherein the 3-D
2 structure is a helical coil.

1 22. The planar structure as claimed in claim 21, wherein the
2 helical coil comprises at least one electrical inductor.

1 23. The planar structure as claimed in claim 21, wherein the
2 helical coil includes first and second spaced rings at opposite ends thereof and
3 wherein each of the rings is formed by an adjacent pair of expanded cross-bands.

1 24. The planar structure as claimed in claim 23, wherein at least
2 the first ring includes a dielectric part which mechanically connects but electrically
3 insulates adjacent portions of the first ring.

1 25. The planar structure as claimed in claim 23, wherein at least
2 the first ring includes a link portion having a mechanical strength lower than other
3 portions of the first ring to allow the first ring to break at the link portion during
4 expansion of the first set of cross-bands to open an electrical path formed by the first
5 ring.

1 26. The planar structure as claimed in claim 1, wherein at least
2 one of the side beams and the cross-bands includes a dielectric part which
3 mechanically connects but electrically insulates adjacent portions of the at least one
4 of the side beams and the cross-bands.

1 27. An assembly comprising:
2 a planar structure including:
3 a pair of spaced side beams which extend along a longitudinal
4 axis; and
5 first and second sets of spaced cross-bands that connect the
6 side beams together; and
7 a balloon mounted on the cross-bands so that adjacent cross-bands are
8 disposed on opposite first and second sides of the balloon wherein inflation of the
9 balloon causes the first set of cross-bands on the first side of the balloon to expand
10 in a first direction and the second set of cross-bands on the second side of the
11 balloon to expand in a second direction substantially opposite the first direction and
12 substantially perpendicular to the longitudinal axis to form a mesh-like, 3-D
13 structure.

1 28. The assembly as claimed in claim 27, wherein the balloon is
2 an angioplasty balloon and the 3-D structure is a tubular stent.

1 29. The assembly as claimed in claim 28, further comprising a
2 catheter tube in fluid communication with the angioplasty balloon.

1 30. A device for use in a electric discharge machining system to
2 form an expandable planar structure from a conductive planar workpiece, the device
3 comprising:
4 a substrate; and
5 a planar electrode formed on the substrate and including a pair of
6 spaced, side electrode members extending along a longitudinal axis to form a pair
7 of side beams of the structure from the workpiece and a plurality of spaced cross-

8 band electrode members to form a plurality of spaced cross-bands of the structure
9 from the workpiece, the cross-bands connecting the side beams together.

1 31. The device as claimed in claim 30, wherein the side electrode
2 members and the cross-band electrode members comprise a plurality of copper
3 structures formed by electroplating the substrate.

1 32. The device as claimed in claim 30, wherein the substrate
2 includes a semiconductor wafer and wherein the side electrode members and the
3 cross-band electrode members comprise a plurality of semiconductor structures
4 formed by removing material from the semiconductor wafer.

1 33. The planar structure as claimed in claim 1, wherein the side
2 beams are substantially straight and continuous.

1 34. The planar structure as claimed in claim 1, wherein the side
2 beams are substantially straight or continuous.

1 35. The planar structure as claimed in claim 1, wherein the 3-D
2 structure comprises at least one electrical conductor.